

Biota of Challenger and Little Markham Islands, off Kawau Island, Hauraki Gulf

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At high tide Challenger (Little Kawau) Island lies just 200 m off the south-eastern tip of the much larger Kawau Island in the Hauraki Gulf (Fig. 1). At low tide it is only separated by a shallow channel c.60 m across, which as Esler (1971) noted, has nevertheless been a barrier for domestic animals, wallabies, possums and fire, and for this reason the vegetation is very different from the adjacent Kawau Island.

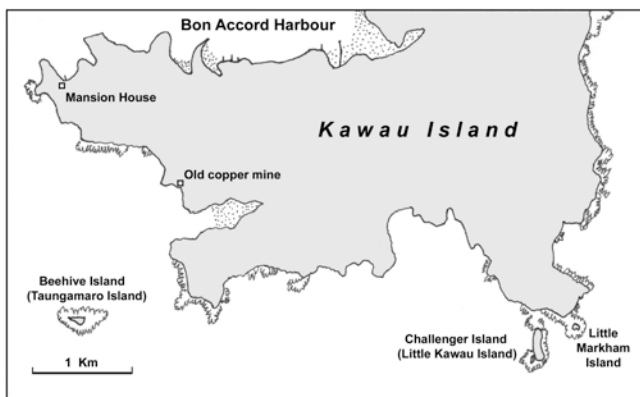


Fig. 1. Location of Challenger Island. Drawn by Ewen Cameron and Josh Salter.



Fig. 2. Aerial view of Challenger Island, near high tide. Image from: Auckland Local Government Geospatial Information group.

Challenger Island lies at 36° 27' 15" S, 174° 52' 24" E, covers 2.85 ha (Taylor 1989), is oblong shaped with the long axis running north-south (c.300 m long x 50-90 m across), and with several small forested rock stacks off the southern end (Fig. 2). The main summit ridge is at a fairly uniform height at c.30 m asl (Figs. 3, 4); in places it is up to 20 m across. It is eroded greywacke rock of Jurassic-Triassic age (Edbrooke 2001) – not Waitemata Sandstone as reported by Esler (1971). There is an extensive rocky shore platform around the island, which almost connects to Kawau Island at low tide. The sides of Challenger Island are steep, with a large active slip on the eastern side by the saddle and a smaller slip opposite on the western side. Access to the summit ridge needs to be carefully chosen, due to steepness. The Government land title is "uninvestigated".

The smaller Little Markham Island (0.35 ha) is c.300 m to the east (less at low tide) of Challenger Island (Fig. 1), but unlike Challenger, its narrower, shallower channel has not been a barrier to wallabies from Kawau Island. It is flat-topped and reaches c.20 m asl.

Flora, Fauna and History of Challenger Island

Based on a visit of "a few hours" on 15 May 1971, Alan Esler (1971) appears to have been the first to record Challenger Island's vascular flora and vegetation; Janet Davidson (1971) briefly recorded the archaeology during the same 1971 Lands and Survey Department organised visit. Two of us visited on 27 June 1989 and recorded the flora and fauna (included in this article); visits in 2001 and 2002 recorded breeding grey-faced petrels (Shaw & Pierce 2002, R. Griffiths pers. comm.); and the most recent survey on 21 February 2011 is published in this article.

The single archaeological site record by Davidson (1971) recorded definite terraces, some midden and hangi stones, and some large water-worn stones, anvil-like, resting in the centre of terraces. Graeme Taylor (GT) and Alan Tennyson (AT) recorded midden shells and terracing in 1989; in 2011 we saw hangi stones at the southern end of the summit ridge and numerous midden shells (including black nerita, pipi, rock oyster) along the summit ridge.

Visit on 27 June 1989

GT and AT visited Challenger Island, from their camp site (26-28 June 1987) on Motutara Island, in an



Fig. 3. West side of Challenger Island. Photo: Mike Wilcox, 21 Feb 2011.

aluminium dinghy as part of a wider Hauraki Gulf seabird survey that they were conducting at that time. They were on Challenger Island from 1300-1500 hrs before briefly visiting Little Markham Island. The plant species were recorded only in passing with no estimates made of abundance.

Visit on 21 February 2011

Three of us (Ewen Cameron (EC), Mike Wilcox (MW) and Maureen Young (MY)) and the skipper, Dick Morrison, set sail from Campbells Beach (5 km SE of Matakana) for Challenger Island, some 14 km distant, in a 22 foot (6.7m) trailer-sailor, *Catch 22*. It was a perfect day – clear sky and enough wind to move the yacht along. The wind was quite gentle until we neared the South Channel and we then had to tack into quite a stiff easterly. After more than two hours sailing we pulled up in the sheltered lee of Challenger Island at 1435 hrs (Fig. 5). Fifteen minutes later we were all rowed ashore and landed about halfway along the western side – Dick remained on the yacht. MW immediately headed off to record and collect the intertidal algae (with a low spring tide of 0.2 m at 1650 hrs), and EC and MY headed northwards round the northern tip and ascended the island through a

steep sward of *Astelia banksii* on the NE part of the island. Once on the summit ridge, access along the fairly flat ridge was straightforward under a forest canopy. We proceeded to the southern end, looked out over the east and west sides where we could; retraced our route and continued to the northern end, and then returned down to the shore platform via the *Astelia* sward where we had ascended. We then proceeded south along the eastern side of the island, but a deep water gut near the southern end prevented us completing a circumnavigation (MW managed to cross it at extreme low water), and we had to retrace our steps back around the island to be picked up at 1715 hrs. Time did not permit us to check the SW end. Little Markham Island was not visited. With the wind behind us, the sail home was



Fig. 5. In the lee on the western side of Challenger Island – last person about to be rowed ashore. Photo: Mike Wilcox, 21 Feb 2011.

nicely direct; seabirds were working (terns and gannets) so a spinner was put out, but, although struck once or twice, no fish were landed. Sailing quietly in a yacht has to be the nicest way to troll for fish! At 1915 hrs we were back at Campbells Beach, and after a cup of tea and some freshly smoked fish courtesy of Dick (with kereru and a kaka active in the adjacent native bush), we were soon headed back on the road to Auckland after a very satisfying afternoon. Unless otherwise stated the observations below relate to the 2011 visit.

Vegetation

Summit ridge

The vegetation in February 2011 was at a fairly advanced stage of regeneration. The summit ridge and the island's flanks were dominated by emergent pohutukawa (*Metrosideros excelsa*) to over 12 m tall. The vegetation along the summit ridge was a continuous canopy, 5-6 m tall, of broadleaf species: kohekohe (*Dysoxylum spectabile*), mahoe (*Melicytus ramiflorus*), wharangi (*Melicope ternata*), tawapou (*Planchonella costata*), karo (*Pittosporum*



Fig. 4. East side of Challenger Island near high tide with the heavily-browsed summit area of Little Markham Island in the foreground. Photo: Alan Tennyson, 27 Jun 1989.

crassifolium) and coastal karamu (*Coprosma macrocarpa*). This was overtopped by emergent pohutukawa about twice the height of the broadleaf canopy. Ground cover was fairly sparse. Clumps of *Gahnia lacera* and *Asplenium oblongifolium* were present along with the occasional patch of grass (mainly *Oplismenus hirtellus*), and leaf litter covered the ground. By the edge of the ridge, tall karo shrubs dominated and shrubs of boneseed (*Chrysanthemoides monilifera*) and tussocks of *Astelia banksii* and flax (*Phormium tenax*) were common.

Island flanks

Open vegetation on these steep, eroding, rocky faces was dominated by scattered large pohutukawa trees with tall shrubs of karo, coastal karamu, boneseed, tussocks of *Astelia banksii* and flax, and low plants of taupata (*Coprosma repens*). In places there were pure swards of *A. banksii* from top to bottom under open pohutukawa trees, e.g. where we ascended. In the open, smaller tussocks of *Ficinia nodosa* were frequent along with various grasses, small mats of *Disphyma australe*, patches of *Pimelea urvilleana* and several dried up annual exotic herbs. Because of the steepness, most of this habitat was recorded from the bottom looking up, or the top looking down.

Vascular Flora

The results for our two separate surveys of vascular plants are presented and compared with the earlier survey by Esler (1971). The total number of plants recorded was roughly similar for each survey. However, the make-up of the flora appeared to have changed between surveys.

Sixteen species were unconfirmed by the second survey and 23 were unconfirmed by the third survey (Table 1 & Appendix). Twelve (17%) of Esler's 1971 records have not been recorded by the two later surveys. There are several possible reasons for these apparent omissions: (1) originally present in low numbers and since died out (e.g. possibly *Avicennia marina*); (2) the surveys were at different times of year and the plants were less/not visible (e.g. seasonal herbs like terrestrial orchids); (3) plants

were simply missed by taking different survey routes.

Similar reasons may explain the apparent new records found during the second and third surveys, e.g. seasonal herbs and taxa simply missed by previous surveys, but some species, like boneseed, may be new arrivals. Forty-six vascular plant species (53.5% of the total flora) were recorded during all three visits (see Appendix), indicating that these species were common, or obvious (e.g. the apparent single *Cordyline australis*). The Auckland Museum herbarium (AK) vascular plant vouchers cited in the Appendix were collected by Esler in 1971 (3), and EC in 2011 (5).

Melicactus macrophyllus was noted by Esler (1971). Mahoe (*M. ramiflorus*) with large leaves was present on the island and we think it was most likely this species that Esler saw because *M. macrophyllus* is not known on any Hauraki Gulf islands except the Great Barrier Island, which because of its large size is similar to the mainland forests rather than an island.

There were only two environmental weeds that deserve management: boneseed and pampas grass (*Cortaderia selloana*) – both were unrecorded in 1971 (Esler 1971) but present by 1989. Pampas grass is currently very local but boneseed is widespread (Appendix 1). Hopefully the biocontrol, boneseed leaf-roller caterpillar (*Tortrix* s.l. sp. "chrysanthemoides" – first released in New Zealand in 2007 on Waiheke Island (*NZ Herald* 30 Mar 2007: A8; Anon. 2011)) may help to control this species.

Seaweeds

The rugged shoreline of this greywacke island does not support a particularly abundant intertidal seaweed flora. Sea urchins (kina) were abundant and may be a factor in the unexpectedly bare rocks. The upper intertidal zone had *Bachelotia antillarum* in rock pools, turfs of *Capreolia implexa*, and colonies of *Rhizoclonium africanum* in crevices. The red crustose alga *Apophlaea sinclairii* was prominent on open rock surfaces. The middle shore had patches of rather

Table 1. Vascular flora totals from three separate surveys of Challenger Island and a single Little Markham Island survey. * = from Esler 1971

Plant Group	Challenger 1971*	Challenger 1989	Challenger 2011	Little Markham 1989	Combined totals
Native ferns	4	4	5	2	5
Native dicots	36	33	28	7	43
Native monocots	17	15	16	2	20
Naturalised dicots	10	7	12	5	14
Naturalised monocots	2	2	2		4
Totals	69	61	63	16	86
(% native)	83	85	78	69	79
New records (naturalised total)		8 (3)	9 (3)		
Previous records unconfirmed (naturalised total)		16 (10)	23 (4)		

stunted *Hormosira banksii*, accompanied by *Corallin officinalis* and *Gelidium caulacanthum*. The brown crustose alga *Ralfsia verrucosa* grew on boulders. *Ectocarpus siliculosus* – a brown fuzzy turf – grew on boulders in the lower intertidal.

Table 2. Herbarium vouchers of seaweeds collected by Mike Wilcox.

Species	Herbarium Voucher No.
<u>Green algae</u>	
<i>Derbesia novae-zelandiae</i>	AK 326519 & AK 326524-25
<i>Rhizoclonium africanum</i>	AK 326527
<u>Brown algae</u>	
<i>Ectocarpus siliculosus</i>	AK 326522
<i>Ralfsia verrucosa</i>	AK 326520
<u>Red algae</u>	
<i>Abroteia suborbiculare</i>	AK 326521
<i>Jania rosea</i>	AK 326523
<i>Melanthalia abscissa</i>	AK 326517
<i>Pterocladia lucida</i>	AK 326518
<i>Pterocladia capillacea</i>	AK 326526

The sublittoral fringe and shallow subtidal zone had the usual Hauraki Gulf assemblage of large brown algae, with *Carpophyllum maschalocarpum* (dominant), *C. plumosum*, *Ecklonia radiata* and *C. flexuosum* (subtidal) and bands of *Cystophora torulosa* and *Xiphophora chondrophylla*.

The only prominent larger red algae were *Melanthalia abscissa*, *Pterocladia lucida* and *Pterocladia capillacea*, the first one being particularly common. Other red algae recorded were *Abroteia suborbiculare* epiphytic on *Carpophyllum maschalocarpum*, and the geniculate coralline alga *Jania rosea*.

Once the tide had fallen to its lowest level, some clefts on the western side of the island became accessible and revealed considerable amounts of the green alga *Derbesia novae-zelandiae*, growing both attached to rock and epiphytic on *Carpophyllum plumosum* and *Pterocladia lucida*. Vouchered algae collections are listed in Table 2.

Fauna

Birds

Seabirds (presumably grey-faced petrels) were recorded by Esler (1971) as having burrowed in one place into deep organic deposits beneath a sward of *Astelias banksii*. In June 1989 c.50 grey-faced petrel burrows, feathers and fresh faeces were recorded at the top of the bank at the southern end of island, and

another three or so burrows were seen elsewhere on the island. Grey-faced petrels were recorded breeding on Challenger Island about September 2001 by Ray Pierce (Shaw & Pierce 2002); and a number of active grey-faced petrel burrows were also noted in 2002 (R. Griffiths pers. comm., 2011).

In June 1989 the following birds were also recorded: little penguin (1 nest/roost site found), pied shag (2), black-backed gull (3), grey warbler (4) and tui (2).

Birds were not specifically surveyed during the February 2011 visit – they were only recorded in passing. Few forest birds were seen or heard: moreporks were seen in the main ridge forest (two together) and starlings were noted. No seabird burrows were seen, but pied shags and black-backed gulls were present perching on rocky outcrops. About six pied shags were present sitting on the beach on Kawau Island just northwest of Challenger Island; their nearest roost or nesting trees seen were just south of the old copper mine on the west coast of Kawau Island some 4 km distant. Pelagic birds seen near the island were: little penguin, Buller's shearwater, flesh-footed shearwater, fluttering shearwater, gannet, Arctic skua, and white-fronted tern.

Mammals

The channel between Kawau and Challenger Islands is apparently wide enough to have prevented the five feral wallaby species (1-2 now extinct), brush-tailed possums and feral cats from reaching Challenger Island. However, it is not a barrier for rodents. GT & AT observed medium-large rat droppings (ship rat (*Rattus rattus*) or Norway rat (*R. norvegicus*)) present and also saw one rat hole (indicating Norway rat) during their visit to Challenger Island in June 1989. Interestingly, only ship rat (in high numbers) and kiore (*R. exulans*) (trapped by T. Wilson in 1998) have so far been recorded for Kawau Island; stoats are present and a ferret was trapped in c.2000 (T. Wilson pers. comm., 2011).

Karo, tawapou and taupata were observed regenerating well on Challenger Island during February 2011 – these species generally do not regenerate well in the presence of the more seed-eating rat species: kiore and ship rat (Atkinson 1972, 1986, Campbell & Atkinson 2002, pers. obs.), compared to the larger Norway rat, e.g. Cameron & Taylor (1991). Tennyson & Taylor (1999) suggested that Norway rats have few impacts on karo but do on taupata. This observation was supported by Grant-Hoffman et al. (2010a) who reported that seeds of karo passed through Norway rats' digestion with no apparent harm to the seedcoat. The rat/ plant interactions seem to be complex (see Grant-Hoffman et al. 2010a,b), with different effects on different islands not fully explained. However, the regenerating woody species present suggest that kiore and ship

rats are absent or suppressed on Challenger Island, and that Norway rats are the main, or only, rat species present.

Little Markham Island

There appear to be no previous accounts of the natural history of Little Markham Island (Fig. 1). When GT & AT landed there on 27 June 1989 for 45 minutes they found wallaby faeces common and observed one wallaby on the island (c.0.5 m tall; brownish-grey pelt, stripey along top of head, long tawny brown tail – probably a brush-tailed rock wallaby). When disturbed it rock-hopped over the intertidal rocks onto Kawau Island. One rat dropping was also noted: it was medium-large (from Norway rat?). Birds seen were: reef heron (1 flying), black-backed gull (4), red-billed gull (3 flying), chaffinch (1) and goldfinch (1). Little Markham Island is separated from Kawau Island by a narrow channel (<5 m across) and the vegetation is totally modified (similar to the adjacent Kawau Island) with no forest cover (partially visible in Fig. 4). Being eight times smaller than Challenger Island, it isn't surprising that the vascular flora is one quarter of its size (Table 1). The only woody species present was boneseed and no species were additional to the Challenger Island flora, except the possibility of the naturalised *Hypochoeris glabra* (see Appendix 1). In the absence of browsing and seed-eating mammals, salt-tolerant, native woody species should occur here, e.g.: karo, taupata, coastal mahoe and possibly pohutukawa.

Discussion

There was a huge contrast between the vegetation of Challenger Island and that of the nearby Little Markham and Kawau Islands. Challenger had an almost continuous forested cover of pohutukawa and understorey of broadleaf species. In contrast, Little Markham and the coastal slopes of Kawau, were dominated by a mixture of bare ground and tussocks of flax and pampas (Kawau only); shoreline pohutukawa was generally missing (Fig. 6), presumably due to possum-browsing on Kawau and possibly also true for Little Markham. On Kawau there was abundant fire-induced kanuka (*Kunzea ericoides*) as well. Unfortunately the small channel between Kawau Island and Little Markham Island deters fewer mammal species than the more significant one separating Challenger Island.

In 1971 Esler recorded coastal mahoe (*Melicactus novae-zelandiae*) as "not common" and no boneseed



Fig. 6. Kawau Island from Challenger Island showing the separating channel c.60 m across near low tide. Note the grazed bare ground on Kawau, with clumps of flax and pampas, abundant kanuka behind and a lack of shoreline pohutukawa trees. Photo: Mike Wilcox, 21 Feb 2011.

on Challenger Island. In 2011 we recorded boneseed as common and did not see any coastal mahoe. If GT and AT had not recorded both as present in 1989 we would have suspected that Esler misidentified the similar-looking boneseed as coastal mahoe because he had only recently moved to Auckland the year before and may not have been familiar with it. Both grow in a similar habitat – open coastal cliff faces, so the spread of boneseed may have contributed to the demise of coastal mahoe. Rats have most likely also been detrimental to coastal mahoe. For instance, by comparing tree populations on islands with and without kiore, and recruitment changes on islands before and after rat eradication, Campbell & Atkinson (2002) showed that kiore depresses recruitment rate of coastal mahoe.

Because of the steep terrain, longer visits are required to make comprehensive surveys of the biotas of Challenger and Little Markham Islands – and any future visits will no doubt increase the species lists. Challenger Island deserves better management to protect the good seed source of broadleaf species and the nesting population of grey-faced petrels by controlling rats (and stoats that probably reach there). Hopefully one day the important gene pool of native species on Challenger Island will be able to spread to Kawau Island when it is mammal-free! Weed control is also required for two species (boneseed and pampas).

Acknowledgements

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Appendix: Annotated vascular flora for three separate surveys of Challenger Island and the single Markham Island survey.

Abbreviations: a = abundant; c = common; l = local; la = locally abundant; lc = locally common; o = occasional; s = scarce (<5 individuals seen);
 ✓ = present; # = from Esler (1971)

	Challenger 15/05/1971#	Challenger 27-Jun-89	Challenger 21-Feb-11	Little Markham 27-Jun-89	Notes based on Challenger Island Feb 2011 observations (unless otherwise stated)
FERNS (5 + 0)					
<i>Asplenium haurakiense</i>	✓	✓	o	✓	Rupestral and terrestrial on steep open flanks
<i>Asplenium oblongifolium</i>	fairly numerous	✓	lc	✓	Under shrubs and forest
<i>Microsorium pustulatum</i>	widespread	✓	o		Among <i>Astelia banksii</i> sward and in forest
<i>Pteridium esculentum</i>			l		Bracken. Single patch, upper E side island, N side of large slip
<i>Pyrrosia eleagnifolia</i>	uncommon	✓	o		Rupestral, terrestrial and as a low epiphyte on pohutukawa
DICOTYLEDONS (43 + 14)					
<i>Anagallis arvensis</i> var. <i>arvensis</i> *	a	✓	lc	✓	Open sites
<i>Apium prostratum</i>		✓			
<i>Avicennia marina</i>	s(1)				Mangrove
<i>Brachyglottis repanda</i>	a few	✓	lc		Rangiora. Summit-ridge forest
<i>Centaureum erythraea</i> *	a few		o		Open sites
<i>Cerastium glomeratum</i> *	✓				
<i>Chrysanthemoides monilifera</i> *		✓	c	✓	Boneseed. In light gaps along the forested summit ridge and also on the island's steep flanks. AK 321994
<i>Cirsium vulgare</i> *	many	✓	o	✓	Scotch thistle. Open sites
<i>Clematis paniculata</i>	a few	✓	lc		Summit-ridge forest
<i>Conyza sumatrensis</i> *	plentiful	✓	la		Open sites throughout
<i>Coprosma lucida</i>	a few				
<i>Coprosma macrocarpa</i>	c	✓	lc		Coastal karamu. Summit-ridge forest and upper open slopes
<i>Coprosma repens</i>	c	✓	lc		Taupata. Open coastal slopes
<i>Corynocarpus laevigatus</i>	s(1)	✓			Taraka

	Challenger 15/05/1971#	Challenger 27-Jun-89	Challenger 21-Feb-11	Little Markham 27-Jun-89	Notes based on Challenger Island Feb 2011 observations (unless otherwise stated)
<i>Cotula australis</i>	la	√		√	
<i>Crassula sieberiana</i>	plentiful	√		√	
<i>Crepis capillaris*</i>			l		Canopy gaps in summit-ridge forest
<i>Dichondra repens</i>	√	√	o	√	Canopy gaps in summit-ridge forest, and open slopes
<i>Disphyma australe</i>	plentiful	√	lc	√	Open coastal slopes
<i>Dysoxylum spectabile</i>	several	√	lc		Summit-ridge forest, 1 tree was c.10m tall on main ridge, most were <6m tall. AK 215524-25
<i>Einadia triandra</i>	a number	√			
<i>Einadia trigonos</i>		√	?lc	√	Eroding coastal slope at southern end, but population couldn't be reached for confirmation of the sp.
<i>Euchiton audax</i>	plentiful	√	lc		Open coastal slopes. AK 217352
<i>Gamochoeta coarctata*</i>	1 place	√	s		Canopy gap in summit-ridge forest
<i>Geniostoma ligustrifolium</i>	A few	√	lc		Hangehange. Summit-ridge forest
<i>Geranium sp.</i>		√			
<i>Haloragis erecta</i>	c				
<i>Hypochaeris radicata*</i>	√	√	o	√	Catsear. Open sites. The species on Little Markham may have been the closely related <i>H. glabra</i>
<i>Leontodon taraxacoides*</i>	not abundant		o		Open sites
<i>Leptecophylla juniperina</i>	s(1)				
<i>Leucopogon fasciculatus</i>	a few	√	s		Single shrub upper slope on W side
<i>Linum monogynum</i>	a number	√			
<i>Lobelia anceps</i>	a few	√			
<i>Macropiper excelsum</i>	several	√	o		Kawakawa. Shrubs to c.1m tall in summit-ridge forest. Leaves rather dull - not the shiny "Hauraki Gulf form" of Gardner (1997)
<i>Melicope ternata</i>	not common	√	la		Wharangi. Small trees and abundant seedlings along summit ridge
<i>Melicytus ?macrophyllus</i>	a few				"...may be vigorous plants of mahoe" (Esler 1971). Record rejected by us
<i>Melicytus novae-zelandiae</i>	many	√			Coastal mahoe
<i>Melicytus ramiflorus</i>	not common	√	lc		Mahoe. Summit-ridge forest

	Challenger 15/05/1971#	Challenger 27-Jun-89	Challenger 21-Feb-11	Little Markham 27-Jun-89	Notes based on Challenger Island Feb 2011 observations (unless otherwise stated)
	<i>Metrosideros excelsa</i>	c	√	c	Pohutukawa. Main emergent canopy species of the upper slopes
	<i>Myrsine australis</i>	plentiful	√	o	Mapou. Shrubs and small trees on summit-ridge forest and coastal slopes
	<i>Olearia furfuracea</i>	s(1)			
	<i>Oxalis rubens</i>			s	Single clump, c.5m asl, east side of N end
	<i>Peperomia urvilleana</i>	√	√	s	Coastal slopes
	<i>Pimelea urvilleana</i>	low levels	√	lc	Open coastal slopes, especially at south end
	<i>Pittosporum crassifolium</i>	c	√	a	Karo. One of the commonest woody plants, most common on the steep island flanks
	<i>Planchonella costata</i>	a number	√	la	Tawapou. Summit ridge forest and local on coastal slopes
	<i>Polycarpon tetraphyllum*</i>			l	Canopy gap in summit-ridge forest
	<i>Pseudognaphalium luteoalbum</i>		√	lc	Open coastal slopes
	<i>Pseudopanax lessonii</i>	la	√	o	Flanks of summit ridge forest
	<i>Ranunculus ?parviflorus*</i>	√			
120	<i>Sarcocornia quinqueflora</i>	several places	√	o	Coastal rocky slopes
	<i>Senecio hispidulus</i>			o	Canopy gaps in summit ridge forest
	<i>Senecio lautus</i>	plentiful	√	o	√ Coastal rocky slopes
	<i>Solanum nodiflorum</i>			l	Open coastal slopes
	<i>Solanum nigrum*</i>			l	Open coastal slopes. AK 321927
	<i>Sonchus oleraceus*</i>	many	√	o	√ Puha. Open coastal slopes
	<i>Stellaria parviflora</i>	s			√
	<i>Wahlenbergia vernicosa</i>	[√]		o	Open rocky slopes. Recorded as "unidentified herb" by Esler. AK 214144

MONOCOTYLEDONS (20 + 4)

	<i>Acianthus sinclairii</i>	x1 colony			
	<i>Anthosachne multiflora</i>	√	√	l	Coastal rocky slopes. (syn. <i>Elymus multiflorus</i>). AK 321883
	<i>Arthropodium cirratum</i>	a number	√	l	Renga renga. Coastal rocky slope, SE side of island

	Challenger 15/05/1971#	Challenger 27-Jun-89	Challenger 21-Feb-11	Little Markham 27-Jun-89	Notes based on Challenger Island Feb 2011 observations (unless otherwise stated)
	<i>Astelia banksii</i>	a	√	a	Pure swards on steep slopes, E side of island
	<i>Carex flagellifera</i>		√		
	<i>CollospERMUM hastatum</i>	some	√	l	Terrestrial summit ridge, S end of island
	<i>Cordyline australis</i>	s(1)	√	s(1)	Single adult, summit ridge near island centre
	<i>Cortaderia selloana*</i>		√	s	Pampas grass. Single clump of 3 tussocks together, upper E side of island, S side of large slip
	<i>Dianella latissima</i>	a few	√	s	Summit ridge near island centre. We presume that the previous records of <i>D. nigra</i> are of this species.
	<i>Dichelachne crinita</i>	a few	√	lc	Open rocky coastal slopes
	<i>Ficinia nodosa</i>	nowhere abundant	√	o	√ Open rocky coastal slopes
	<i>Gahnia lacera</i>	a few	√	lc	Summit forest ridge
	<i>Gahnia setifolia</i>	a few			
	<i>Holcus lanatus*</i>		√		
121	<i>Lachnagrostis billarderei</i>	plentiful	√	lc	Rocky coastal slopes
	<i>Lachnagrostis littoralis</i>			lc	Rocky coastal slopes
	<i>Microlaena stipoides</i>			l	Summit ridge forest
	<i>Oplismenus hirtellus</i>	some	√	o	Summit ridge forest
	<i>Parapholis incurva*</i>	√			
	<i>Phormium tenax</i>	locally plentiful	√	o	√ Flax. Coastal slopes
	<i>Poa anceps</i>	a few	√	l	Upper island, semi-shaded slopes
	<i>Rytidosperma unarede</i>	nowhere abundant	√	o	Danthonia. Upper open flanks of island, and light gaps in ridge forest (recorded previously only as <i>Rytidosperma</i> sp.). AK 321990
	<i>Thelymitra</i> sp.	√			
	<i>Vulpia bromiodes*</i>	a		la	Open sites